(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 534 972 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**16.01.2008 Bulletin 2008/03**

(21) Application number: **03771041.5**

(22) Date of filing: **25.07.2003**

(51) Int Cl.:
***F16D 41/20*** *(2006.01)*

(86) International application number:
**PCT/CA2003/001168**

(87) International publication number:
**WO 2004/011818 (05.02.2004 Gazette 2004/06)**

(54) **OVERRUNNING ALTERNATOR DECOUPLER PULLEY WITH BARE WIRE SPRING AND GREASE LUBRICATION**

TRENNSCHEIBE FÜR WEITERLAUFENDEN DREHSTROMGENERATOR MIT BLANKDRAHTFEDER UND FETTSCHMIERUNG

POULIE A ROUE LIBRE DE DECOUPLEUR D'ALTERNATEUR DOTEE D'UN FAIBLE RESSORT EN FILS ET D'UNE LUBRIFICATION PAR GRAISSE

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR**

(30) Priority: **26.07.2002 US 398979 P**

(43) Date of publication of application:
**01.06.2005 Bulletin 2005/22**

(60) Divisional application:
**07001751.2 / 1 772 644**

(73) Proprietor: **Litens Automotive Woodbridge, Ontario L4L 5T9 (CA)**

(72) Inventors:
- **JANSEN, Christian Thornhill, Ontario L3T 7Y6 (CA)**
- **ANTCHAK, John Innisfil, Ontario L9S 4A6 (CA)**

(74) Representative: **Grünecker, Kinkeldey, Stockmair & Schwanhäusser Anwaltssozietät Maximilianstrasse 58 80538 München (DE)**

(56) References cited:
**WO-A-01/92746**
**US-A- 5 437 205**
**US-A- 6 083 130**



EP 1 534 972 B1

## Description

### Field of the Invention

**[0001]** The invention relates to a belt drive assembly for driving belt driven accessories in an engine of an automotive vehicle, and more particularly, to a decoupling mechanism for allowing the belt drive accessories to operate temporarily at a speed other than the belt drive assembly.

### Description of the Prior Art

**[0002]** It is widely know in an automotive vehicle engine to transfer a portion of the engine output to a plurality of belt driven accessories utilizing an endless serpentine belt. Typically, each component includes an input drive shaft and a pulley coupled to a distal end of the drive shaft for driving engagement with the bolt. An example of such a belt driven accessory is an alternator.

**[0003]** It is also know to provide a decoupler operatively coupled between the pulley and the alternator to allow the alternator drive shaft to "overrun" or rotate at a faster speed than the pulley and to allow the speed of the pulley to oscillate with respect to the alternator drive shaft due to oscillations in the engine speed.

**[0004]** Examples of decouplers are disclosed in the United States Patent 6,083,130, issued to Mevissen et al. on July 4, 2000 and the United States Patent 5,139,463, issued to Bytzek et al. on August 18, 1992.

**[0005]** US 6,083,130 relates to a decoupler comprising a coated wrap spring clutch structure, in which the spring steel material is coated with friction material for engagement with an interior surface of a pulley. The friction material is a rubber friction enhancing material wherein preferably a so-called "T-701" rubber-based material is used. The decoupler comprises a coil spring, positioned between an annular flange portion and a ring structure. The annular flange portion is integrally formed with a hub, and the ring structure is positioned within an annular end cap fixedly attached to the hub structure.

**[0006]** WO 01/92746 discloses a clutch spring directly coupling a hub member with a pulley. It remains desirable, i.e. it is the object of the present invention, to provide a decoupler that is easy to manufacture and has good durability.

### SUMMARY OF THE INVENTION

**[0007]** According to the present invention, the object is solved by a decoupler assembly comprising the features of independent claim 1.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]** Advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a front view of an engine of an automotive vehicle incorporating a decoupler assembly according to one aspect of the invention;
Figure 2 is an enlarged fragmentary sectional view of the decoupler assembly;
Figure 3 is a perspective view of a clutch spring in the decoupler assembly;
Figure 4 is a perspective view of a carrier for carrying one end of the clutch spring in the decoupler assembly;
Figure 5 is a perspective view of the clutch spring assembled to the carrier.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0009]** Referring to the figures, an engine for an automotive vehicle is generally indicated at 10 in Figure 1. The engine 10 includes a crankshaft 12 driving an endless serpentine belt 14, as commonly known by those having ordinary skill in the art. The engine 10 also includes a belt driven accessory 16 driven by the belt 14. Described in greater detail below, a decoupler assembly 20 is operatively assembled between the belt 14 and the belt driven accessory 16 for automatically decoupling the belt driven accessory 16 from the belt 14 when the belt 14 decelerates relative to the belt driven accessory 16 and allowing the speed of the belt 14 to oscillate relative to the belt driven accessory 16. Additionally, a detailed description of the structure and function of a decoupler assembly can be found in applicant's United States Patent 6,083,130, which issued on July 4, 2000.

**[0010]** Referring to Figure 2, the decoupler assembly 20 includes a hub 22 having opposite first 24 and second 26 ends and a generally cylindrical body 28 extending axially therebetween. The body 28 includes opposite inner 30 and outer 32 surfaces extending between the first 24 and second 26 ends of the hub 22. The inner surface 30 includes a plurality of inner threads 33 adjacent the first end 24 for fixedly securing the hub 22 to a drive shaft 15 from the belt driven accessory 16. A reduced diameter portion 34 is formed in the first end 24. The reduced diameter portion 34 includes an outer mounting surface 36 having a smaller outer diameter than the body 28. An abutment surface 38 opposite the second end 26 extends generally radially between the outer mounting surface 36 and the body 28. An annular thrust washer 39 is seated on the outer mounting surface 36 adjacent the abutment surface 38.

**[0011]** A socket 40 is formed in the second end 26 for receiving a suitable tool therein for rotatably threading the hub 22 onto the drive shaft 15. An annular first flange 41 extends radially outwardly from the body 28 adjacent the second end 26. The first flange 41 includes an outer flange surface 42 having a larger outer diameter than the

body 28. An annular surface 44 extends generally radially between the body 28 and the outer flange surface 42 opposite the second end 26. A generally helical first slot 46 is formed in the annular surface 44 defining a first locating surface 48 therein.

**[0012]** A generally cylindrical pulley 50 is rotatably journaled to the hub 22. More specifically, the pulley 50 extends between opposite first 52 and second 54 ends. The pulley 50 includes an inner surface 56 extending between the first 52 and second 54 ends. A ball bearing member 57 is coupled between the pulley 50 and the hub 22. The bearing member 57 includes an inner race 58 fixedly secured to a portion of the outer mounting surface 36 and an outer race 59 fixedly secured to a portion of the inner surface 56 adjacent the first end 52 of the pulley 50. A plurality of ball bearings 55 is rollingly engaged between the inner 58 and outer 59 races of the bearing member 57. A cylindrical bushing 60 is journal mounted between the pulley 50 and the first flange 41. The bushing 60 includes a sleeve wall 62 extending between a portion of the inner surface 56 adjacent the second end 54 and the outer flange surface 42 of the first flange 41. A bushing bushing flange 64 extends radially inwardly from the sleeve wall 62 and abuts the annular surface 44 in the first flange 41.

**[0013]** The pulley 50 includes an outer periphery 66 with a plurality of V-shaped grooves 68 formed therein for rollingly engaging and guiding the belt 14.

**[0014]** Referring to Figures 2-5, a one-way clutch assembly 70 is operatively coupled between the hub 22 and the pulley 50. The clutch assembly 70 includes a clutch spring 71 and a carrier 75. The clutch spring 71 includes a plurality of helical coils 72 extending between a bent or hooked proximal end 73 and an opposite distal end 74. Preferably, the clutch spring 71 is formed from an uncoated, spring steel material and has a non-circular cross-section to improve frictional contact. Most preferably, the cross-section of clutch spring 71 is rectangular or square. The clutch spring 71 is press fitted into frictional engagement with the inner surface 56 of the pulley 50. Preferably, a lubricant similar or compatible with grease used in the ball bearing member 57 is applied to minimize wear between the clutch spring 71 and the inner surface 56 of the pulley 50.

**[0015]** The carrier 75 is rotatably mounted on the hub 22. The carrier 75 is generally ring shaped and extends axially between opposite first and second sides 76, 78. A hooked slot 84 is formed in the second side 78 of the carrier 75 and is configured to retain the hooked proximal end 73 of the clutch spring 71. A generally helical second slot 86 is formed in the second side 78 of the carrier 75 defining a second locating surface 88 generally opposing the first locating surface 48 formed in the annular surface 44.

**[0016]** Referring to Figure 2, a helical torsion spring 90 extends between hub 92 and carrier 94 ends. The torsion spring 90 is axially compressed between the first 48 and second 88 locating surfaces for transferring torque between the hub 22 and the carrier 75. More specifically, the hub end 92 of the torsion spring 90 is retained in the first slot 46 of the hub 22. Similarly, the carrier end 94 of the torsion spring 90 is retained in the second slot 86 in the second side 78 of the carrier 75. Axial forces due to the compression of the torsion spring 90 retains the first side 76 of the carrier 75 in abutting engagement with the thrust washer 39. The torsion spring 90 also allows relative movement between the carrier 75 and the hub 22 to accommodate changes in the speed of the pulley 50 due to generally oscillating changes in the operating speed of the engine. The torsion spring 90 and the clutch spring 71 are coiled in opposite directions.

**[0017]** A cap 100 is fixedly assembled to a flange 102 formed in the pulley 50 for preventing contaminants from entering the decoupler assembly 20 and for retaining the lubricant within the decoupler assembly 20.

**[0018]** In operation, the engine 10 is started and the pulley 50 is accelerated and rotated in a driven direction by the belt 14 driven by the engine 10. Acceleration and rotation of the pulley 50 in the driven direction relative to the hub 22 creates friction between the inner surface 56 of the pulley 50 and preferably all of the coils 72 of the clutch spring 71. It should be appreciated that the clutch spring 71 will function even where at the onset at least one of the coils 72 of the clutch spring 71 is frictionally engaged with the inner surface 56 of the pulley 50. The clutch spring 71 is helically coiled such that the friction between the inner surface 56 of the pulley 50 and at least one of the coils 72 would cause the clutch spring 71 to expand radially outwardly toward and grip the inner surface 56 of the pulley 50. Continued rotation of the pulley 50 in the driven direction relative to the hub 22 would cause a generally exponential increase in the outwardly radial force applied by the coils 72 against the inner surface 56 until all of the coils 72 of the clutch spring 71 become fully brakingly engaged with the pulley 50. When the clutch spring 71 is fully engaged with the inner surface 56, the rotation of the pulley 50 is fully directed toward rotation of the drive shaft 15 of the belt driven accessory 16. Additionally, centrifugal forces help to retain the clutch spring 71 in braking engagement with the inner surface 56 of the pulley 50.

**[0019]** The rotational movement of the carrier 75 in the driven direction is transferred to the hub 22 by the torsional spring 90 such that generally the carrier 75, thrust washer 39, hub 22, and the drive shaft 15 from the belt driven accessory 16 rotate together with the pulley 50. Additionally, the torsional spring 90 resiliently allows relative movement between the carrier 75 and the hub 22 to accommodate oscillations in the speed of the pulley 50 due to corresponding oscillations in the operating speed of the engine 10.

**[0020]** When the pulley 50 decelerates, the hub 22 driven by the inertia associated with the rotating drive shaft 15 and the rotating mass within the belt driven accessory 16 will initially "overrun" or continue to rotate in the driven direction at a higher speed than the pulley 50.

More specifically, the higher rotational speed of the hub 22 relative to the pulley 50 causes the clutch spring 71 to contract radially relative to the inner surface 56 of the pulley 50. The braking engagement between the clutch spring 71 and the pulley 50 is relieved, thereby allowing overruning of the hub 22 and drive shaft 15 from the belt driven accessory 16 relative to the pulley 50. The coils 72 may remain frictionally engaged with the inner surface 56 while the pulley 50 decelerates relative to the clutch assembly 70 and the hub 22. The coils 72 of the clutch spring 71 begin to brakingly reengage the inner surface 56 as the pulley 50 accelerates beyond the speed of the hub 22.

**[0021]** The invention has been described in an illustrative manner, and it is to be understood that the terminology, which has been used, is intended to be in the nature of words of description rather than of limitation. Many modification and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced other than as specifically described.

## Claims

1. A decoupler assembly (20) for transferring torque between a shaft (15) and a drive belt (14) of an engine, said decoupler assembly comprising:

   a hub (22) configured to be fixedly assembled to the shaft (15), said hub (22) including a helical first slot (46) formed therein;
   a carrier (75) rotatably mounted on said hub (22), said carrier (75) including a helical second slot (86) formed therein;
   a torsion spring (90) extending between a hub end (92) and a carrier end (94) for transferring torque between said hub (22) and carrier (75), wherein said hub end (92) is retained in said helical first slot (46) to prevent relative movement between said hub end (92) of said torsion spring (90) and said hub (22) and said carrier end (94) is retained in said helical second slot (28) to prevent relative movement between said carrier end (94) of said torsion spring (90) and said carrier (75);
   a pulley (50) rotatably coupled to said hub (22), said pulley (50) having an outer periphery (66) configured to frictionally engage with the drive belt (14), said pulley (50) having an inner surface (56) formed therein;
   a bearing member (57) operatively assembled between said pulley (50) and said hub (22) for rotatably mounting said pulley (50) on said hub (22);
   a clutch spring (71) fixedly secured to said carrier (75) and having a plurality of helical coils (72) formed from an uncoated spring steel material and frictionally engaging with said inner surface (56) of said pulley (50) to selectively couple said hub (22) and pulley (50), said torsion spring (90) and said clutch spring (71) wound in opposite senses enabling said clutch spring (71) to expand into gripping engagement with said inner surface (56) during acceleration of said pulley (50) relative to said hub (22) and to contract out of gripping engagement with said inner surface (56) during deceleration of said pulley (50) relative to said hub (22);
   a lubricant disposed between said clutch spring (71) and said inner surface (56) of the pulley (50) for minimizing wear therebetween, said lubricant being similar or compatible with grease in the bearing member (57); and
   a thrust washer (39) seated on said hub (22) in abutting engagement with said carrier (75).

2. A decoupler assembly as set forth in claim 1 wherein said hub (22) includes a body extending axially between first and second ends (24, 26).

3. A decoupler assembly as set forth in claim 2 wherein said hub (22) includes a cylindrical outer surface (32) extending between said first and second ends (24, 26).

4. A decoupler assembly as set forth in claim 3 wherein said hub (22) includes a first flange (41) extending radially outwardly from said body (28) to define an outer flange surface (42) having a larger diameter than said body (28).

5. A decoupler assembly as set forth in claim 4 wherein said first flange (41) includes an annular surface (48) extending radially between said body (28) and said outer flange surface (42).

6. A decoupler assembly as set forth in claim 5 wherein said helical first slot (46) is formed in said annular surface (48) for retaining therein said hub end (92) of said torsion spring (90) for preventing relative movement between said hub end (92) of said torsion spring (90) and said hub (22).

7. A decoupler assembly as set forth in claim 6 wherein said hub (22) includes a reduced diameter portion (34) having an outer mounting surface (36) having a smaller diameter than said body (28) of said hub (22).

8. A decoupler assembly as set forth in claim 7 wherein said hub (22) includes an abutment surface (38) extending radially between said body (28) and said outer mounting surface (36).

9. A decoupler assembly as set forth in claim 8 wherein said carrier (75) is ring shaped and extends axially between opposite first and second sides (76, 78).

10. A decoupler assembly as set forth in claim 9 wherein said helical second slot (86) is formed in one of said first and second sides (76, 78) of said carrier (75) for retaining therein said carrier end (94) of said torsion spring (90) for preventing relative movement between said carrier end (94) of said torsion spring (90) and said carrier (75).

11. A decoupler assembly as set forth in claim 10 wherein clutch spring (71) extends between a hooked proximal end (73) and an opposite distal end (74).

12. A decoupler assembly as set forth in claim 11 wherein at least one of said first and second ends (76, 78) of said carrier (75) includes a hooked slot (84) for retaining therein said hooked proximal end (73) of said clutch spring (71) to prevent relative movement between said hooked proximal end (73) of said clutch spring (71) and said carrier (75).

13. A decoupler assembly as set forth in claim 12 wherein said clutch spring (71) includes a non-circular cross-section to improve frictional engagement between said plurality of coils (72) and said inner surface (56) of said pulley (50).

14. A decoupler assembly as set forth in claim 13 wherein the lubricant disposed between the clutch spring (71) and the inner surface (56) of the pulley (50) is a first lubricant, and said decoupler assembly (20) includes a second lubricant operatively associated with said bearing member (57) for minimizing frictional wear therein, said first lubricant being compatible with said second lubricant such that said decoupler (20) continues to function if said second lubricant is displaced from said bearing member (57) and mixes with said first lubricant between said clutch spring (71) and said inner surface (56).

15. A decoupler assembly as set forth in claim 14 wherein said bearing member includes a ball bearing assembly (57) having an inner race (58) engaging said hub (22) and an outer race (59) engaging said pulley (50).

16. A decoupler assembly as set forth in claim 15 wherein said thrust washer (39) is seated on said outer mounting surface (36) of said reduced diameter portion (34) for axially compressing said torsion spring (90) between said carrier (75) and said hub (22).

17. A decoupler assembly as set forth in claim 16 wherein said inner race (58) of said ball bearing assembly (57) is press fit onto said outer mounting surface (36) of said reduced diameter portion (34) to retain said thrust washer (39) against said abutment surface (38) whereby said axial compression of said torsion spring (90) is maintained.

18. A decoupler assembly as set forth in claim 17 wherein said carrier includes a split to allow said carrier to flex and accommodate loads associated with rotation of said decoupler assembly.

**Patentansprüche**

1. Entkuppleranordnung (20) zum Übertragen von Drehmoment zwischen einer Welle (15) und einem Antriebsriemen (14) eines Motors, wobei die Entkuppleranordnung umfasst:

eine Nabe (22), konfiguriert, um fest an der Welle (15) montiert zu sein, wobei die Nabe (22) einen darin ausgebildeten spiralförmigen ersten Schlitz (46) aufweist,
einen Träger (75), drehbar auf der Nabe (22) angebracht, wobei der Träger (75) einen darin ausgebildeten spiralförmigen zweiten Schlitz (86) aufweist,
eine Torsionsfeder (90), die sich zwischen einem Nabenende (92) und einem Trägerende (94) erstreckt, zum Übertragen von Drehmoment zwischen der Nabe (22) und dem Träger (75), wobei das Nabenende (92) in dem spiralförmigen ersten Schlitz (46) gehalten wird, um Relativbewegung zwischen dem Nabenende (92) der Torsionsfeder (90) und der Nabe (22) zu verhindern, und das Trägerende (94) in dem spiralförmigen zweiten Schlitz (98) gehalten wird, um Relativbewegung zwischen dem Trägerende (94) der Torsionsfeder (90) und dem Träger (75) zu verhindern,
eine Riemenscheibe (50), drehbar mit der Nabe (22) gekoppelt, wobei die Riemenscheibe (50) einen Außenumfang (66) aufweist, der konfiguriert ist, um in Reibungseingriff mit dem Antriebsriemen (14) zu kommen, und die Riemenscheibe (50) eine Innenfläche (56) darin ausgebildet aufweist, wobei ein Lagerelement (57) wirkend zwischen der Riemenscheibe (50) und der Nabe (22) zum drehbaren Anbringen der Riemenscheibe (50) auf der Nabe (22) montiert ist,
eine Kupplungsfeder (71), fest an dem Träger (75) gesichert und mit einer Vielzahl von spiralförmigen Windungen (72), gebildet aus einem unbeschichteten Federstahlmaterial und in Reibungseingriff mit der Innenfläche (56) der Riemenscheibe (50), um die Nabe (22) und die Riemenscheibe (50) selektiv zu kuppeln, wobei die Torsionsfeder (90) und die Kupplungsfeder (71), in entgegengesetzte Richtungen gewunden,

der Kupplungsfeder (71) ermöglichen, sich während Beschleunigung der Riemenscheibe (50) relativ zu der Nabe (22) in Klemmeingriff mit der Innenfläche (56) auszudehnen und sich während Geschwindigkeitsabnahme der Riemenscheibe (50) relativ zu der Nabe (22) außer Klemmeingriff mit der Innenfläche (56) zusammenzuziehen,
einen Schmierstoff, aufgebracht zwischen der Kupplungsfeder (71) und der Innenfläche (56) der Riemenscheibe (50), zum Minimieren von Verschleiß dazwischen, wobei das Schmiermittel gleichartig dem Fett in dem Lager oder mit diesem kompatibel ist, und
einen Druckring (39), auf der Nabe (22) gelagert, in Druckeingriff mit dem Träger (75).

2. Entkuppleranordnung nach Anspruch 1, wobei die Nabe (22) einen Körper enthält, der sich axial zwischen ersten und zweiten Enden (24, 26) erstreckt.

3. Entkuppleranordnung nach Anspruch 2, wobei die Nabe (22) eine zylindrische Außenfläche (32) enthält, die sich zwischen ersten und zweiten Enden (24, 26) erstreckt.

4. Entkuppleranordnung nach Anspruch 3, wobei die Nabe (22) einen ersten Flansch (41) enthält, der sich radial auswärts von dem Körper (28) erstreckt, um eine äußere Flanschfläche (42), die einen größeren Durchmesser als der Körper (28) aufweist, zu bilden.

5. Entkuppleranordnung nach Anspruch 4, wobei der erste Flansch (41) eine ringförmige Fläche (48) enthält, die sich radial zwischen dem Körper (28) und der äußeren Flanschfläche (42) erstreckt.

6. Entkuppleranordnung nach Anspruch 5, wobei der spiralförmige erste Schlitz (46) in der ringförmigen Fläche (48) ausgebildet ist, um darin das Nabenende (92) der Torsionsfeder (90) festzuhalten, so dass Relativbewegung zwischen dem Nabenende (92) der Torsionsfeder (90) und der Nabe (22) verhindert wird.

7. Entkuppleranordnung nach Anspruch 6, wobei die Nabe (22) einen Teil (34) reduzierten Durchmessers enthält, der eine äußere Montagefläche (36) hat, die einen kleineren Durchmesser als der Körper (28) der Nabe (22) aufweist.

8. Entkuppleranordnung nach Anspruch 7, wobei die Nabe (22) eine Anschlagsfläche (38) enthält, die sich radial zwischen dem Körper (28) und der äußeren Montagefläche (36) erstreckt.

9. Entkuppleranordnung nach Anspruch 8, wobei der Träger (75) ringförmig ist und sich axial zwischen gegenüberliegenden ersten und zweiten Seiten (76, 78) erstreckt.

10. Entkuppleranordnung nach Anspruch 9, wobei der spiralförmige zweite Schlitz (86) in einer von der ersten und der zweiten Seite (76, 78) des Trägers (75) zum Festhalten des Trägerendes (94) der Torsionsfeder (90) ausgebildet ist, so dass Relativbewegung zwischen dem Trägerende (94) der Torsionsfeder (90) und dem Träger (75) verhindert wird.

11. Entkuppleranordnung nach Anspruch 10, wobei sich die Kupplungsfeder (71) zwischen einem hakenförmigen proximalen Ende (73) und einem gegenüberliegenden distalen Ende (74) erstreckt.

12. Entkuppleranordnung nach Anspruch 11, wobei wenigstens eines von den ersten und den zweiten Enden (76, 78) des Trägers (75) einen hakenförmigen Schlitz (84) zum Festhalten des hakenförmigen proximalen Endes (73) der Kupplungsfeder (71) darin enthält, um Relativbewegung zwischen dem hakenförmigen proximalen Ende (73) der Kupplungsfeder (71) und des Trägers (75) zu verhindern.

13. Entkuppleranordnung nach Anspruch 12, wobei die Kupplungsfeder (71) einen nicht kreisförmigen Querschnitt enthält, um den Reibungseingriff zwischen der Vielzahl von Windungen (72) und der Innenfläche (56) der Riemenscheibe (50) zu verbessern.

14. Entkuppleranordnung nach Anspruch 13, wobei das Schmiermittel, vorgesehen zwischen der Kupplungsfeder (71) und der Innenfläche (56) der Riemenscheibe (50), ein erstes Schmiermittel ist und die Entkuppleranordnung (20) ein zweites Schmiermittel enthält, das wirkend mit dem Lagerelement (57) verbunden ist, um Reibungsverschleiß darin zu minimieren, wobei das erste Schmiermittel mit dem zweiten Schmiermittel kompatibel ist, so dass der Entkuppler (20) fortgesetzt funktioniert, wenn das zweite Schmiermittel von dem Lagerelement (57) verdrängt wird und sich mit dem ersten Schmiermittel zwischen der Kupplungsfeder (71) und der Innenfläche (56) mischt.

15. Entkuppleranordnung nach Anspruch 14, wobei das Lagerelement eine Kugellageranordnung (57) mit einem inneren Laufring (58), der mit der Nabe (22) in Eingriff ist, und einem äußeren Laufring (59), der mit der Riemenscheibe (50) in Eingriff ist, enthält.

16. Entkuppleranordnung nach Anspruch 15, wobei der Druckring (39) auf der äußeren Montagefläche (36) des Teils (34) reduzierten Durchmessers gelagert ist, um die Torsionsfeder (39) zwischen dem Träger (75) und der Nabe (22) axial zu komprimieren.

17. Entkuppleranordnung nach Anspruch 16, wobei der innere Laufring (58) der Kugellageranordnung (57) auf die äußere Montagefläche (36) des Teils (34) reduzierten Durchmessers pressgepasst ist, um den Druckring (39) an der Anschlagsfläche (38) zu halten, wodurch die axiale Kompression der Torsionsfeder (90) vorgehalten wird.

18. Entkuppleranordnung nach Anspruch 17, wobei der Träger einen Spalt enthält, um dem Träger zu ermöglichen, sich zu biegen und Belastungen aufzunehmen, die mit der Rotation der Entkuppleranordnung verbunden sind.

**Revendications**

1. Ensemble de découpleur (20) permettant de transférer un couple entre un arbre (15) et une courroie d'entraînement (14) d'un moteur, ledit ensemble de découpleur comprenant :

un moyeu (22) configuré pour être assemblé fixement à l'arbre (15), ledit moyeu (22) incluant une première fente hélicoïdale (46) formée dans celui-ci ;
un élément porteur (75) monté pour tourner sur ledit moyeu (22), ledit élément porteur (75) incluant une deuxième fente hélicoïdale (86) formée dans celui-ci ;
un ressort de torsion (90) s'étendant entre une extrémité de moyeu (92) et une extrémité d'élément porteur (94) permettant de transférer un couple entre ledit moyeu (22) et l'élément porteur (75), ladite extrémité de moyeu (92) étant retenue dans ladite première fente hélicoïdale (46) pour empêcher tout mouvement relatif entre ladite extrémité de moyeu (92) dudit ressort de torsion (90) et ledit moyeu (22), et ladite extrémité d'élément porteur (94) étant retenue dans ladite deuxième fente hélicoïdale (86) pour empêcher tout mouvement relatif entre ladite extrémité d'élément porteur (94) dudit ressort de torsion (90) et ledit élément porteur (75) ;
une poulie (50) reliée audit moyeu (22) en pouvant tourner par rapport à celui-ci, ladite poulie (50) ayant une périphérie externe (66) configurée pour s'engager par frottement avec la courroie d'entraînement (14), ladite poulie (50) ayant une surface interne (56) formée dans celle-ci, un élément de palier (57) étant assemblé de façon opérationnelle entre ladite poulie (50) et ledit moyeu (22) pour monter ladite poulie (50) sur ledit moyeu (22) afin qu'elle puisse tourner ;
un ressort d'embrayage (71) attaché fixement audit élément porteur (75), ayant une pluralité d'enroulements hélicoïdaux formés à partir d'un matériau en acier à ressort non revêtu, et s'engageant par frottement avec ladite surface interne (56) de ladite poulie (50) pour coupler sélectivement ledit moyeu (22) et ladite poulie (50), ledit ressort de torsion (90) et ledit ressort d'embrayage (71) étant enroulés dans des sens opposés, ce qui permet que ledit ressort d'embrayage (71) s'expanse en engagement par accrochage avec ladite surface interne (56) lors de l'accélération de ladite poulie (50) par rapport audit moyeu (22), et se dégage de l'engagement par accrochage avec ladite surface interne (56) lors de la décélération de ladite poulie (50) par rapport audit moyeu (22) ;
un lubrifiant disposé entre ledit ressort d'embrayage (71) et ladite surface interne (56) de la poulie (50) pour minimiser l'usure entre eux, ledit lubrifiant étant analogue à, ou compatible avec, la graisse présente dans l'élément de palier (57) ; et
une rondelle de butée (39) assise sur ledit moyeu (22) dans un engagement à butée avec ledit élément porteur (75).

2. Ensemble de découpleur selon la revendication 1, dans lequel ledit moyeu (22) inclut un corps (28) s'étendant axialement entre des première et deuxième extrémités (24, 26).

3. Ensemble de découpleur selon la revendication 2, dans lequel ledit moyeu (22) inclut une surface externe cylindrique (32) s'étendant entre lesdites première et deuxième extrémités (24, 26).

4. Ensemble de découpleur selon la revendication 3, dans lequel ledit moyeu (22) inclut un premier épaulement (41) s'étendant radialement vers l'extérieur à partir dudit corps (28) pour définir une surface d'épaulement externe (42) ayant un diamètre plus grand que celui dudit corps (28).

5. Ensemble de découpleur selon la revendication 4, dans lequel ledit premier épaulement (41) présente une surface annulaire (48) s'étendant radialement entre ledit corps (28) et ladite surface d'épaulement externe (42).

6. Ensemble de découpleur selon la revendication 5, dans lequel ladite première fente hélicoïdale (46) est formée dans ladite surface annulaire (48) pour y retenir ladite extrémité de moyeu (92) dudit ressort de torsion (90), afin d'empêcher tout mouvement relatif entre ladite extrémité de moyeu (92) dudit ressort de torsion (90) et ledit moyeu (22).

7. Ensemble de découpleur selon la revendication 6, dans lequel ledit moyeu (22) inclut une partie de diamètre réduit (34), ayant une surface de montage externe (36) de diamètre plus petit que celui dudit corps

(28) dudit moyeu (22).

8. Ensemble de découpleur selon la revendication 7, dans lequel ledit moyeu (22) inclut une surface de butée (38) s'étendant radialement entre ledit corps (28) et ladite surface de montage externe (36).

9. Ensemble de découpleur selon la revendication 8, dans lequel ledit élément porteur (75) est en forme d'anneau, et s'étend axialement entre des premier et deuxième côtés opposés (76, 78).

10. Ensemble de découpleur selon la revendication 9, dans lequel ladite deuxième fente hélicoïdale (86) est formée dans l'un desdits premier et deuxième côtés (76, 78) dudit élément porteur (75), pour y retenir ladite extrémité d'élément porteur (94) dudit ressort de torsion (90) afin d'empêcher tout mouvement relatif entre ladite extrémité d'élément porteur (94) dudit ressort de torsion (90) et ledit élément porteur (75).

11. Ensemble de découpleur selon la revendication 10, dans lequel le ressort d'embrayage (71) s'étend entre une extrémité proximale à crochet (73) et une extrémité distale opposée (74).

12. Ensemble de découpleur selon la revendication 11, dans lequel au moins l'une desdites première et deuxième extrémités (76, 78) dudit élément porteur (75) inclut une fente à crochet (84) permettant d'y retenir ladite extrémité proximale à crochet (73) dudit ressort d'embrayage (71), afin d'empêcher tout mouvement relatif entre ladite extrémité proximale à crochet (73) dudit ressort d'embrayage (71) et ledit élément porteur (75).

13. Ensemble de découpleur selon la revendication 12, dans lequel ledit ressort d'embrayage (71) présente une section transversale non circulaire afin d'améliorer l'engagement par frottement entre ladite pluralité d'enroulements (72) et ladite surface interne (56) de ladite poulie (50).

14. Ensemble de découpleur selon la revendication 13, dans lequel le lubrifiant disposé entre le ressort d'embrayage (71) et la surface interne (56) de la poulie (50) est un premier lubrifiant, et ledit ensemble de découpleur (20) inclut un deuxième lubrifiant associé de façon opérationnelle audit élément de palier (57) pour minimiser l'usure par frottement dans celui-ci, ledit premier lubrifiant étant compatible avec ledit deuxième lubrifiant, de sorte que ledit découpleur (20) continue à fonctionner si ledit deuxième lubrifiant est déplacé par rapport audit élément de palier (57), et se mélange avec ledit premier lubrifiant présent entre ledit ressort d'embrayage (71) et ladite surface interne (56).

15. Ensemble de découpleur selon la revendication 14, dans lequel ledit élément de palier comporte un ensemble de roulement à billes (57) ayant une bague interne (58) s'engageant avec ledit moyeu (22) et une bague externe (59) s'engageant avec ladite poulie (50).

16. Ensemble de découpleur selon la revendication 15, dans lequel ladite rondelle de butée (39) est assise sur ladite surface de montage externe (36) de ladite partie de diamètre réduit (34) pour comprimer axialement ledit ressort de torsion (90) entre ledit élément porteur (75) et ledit moyeu (22).

17. Ensemble de découpleur selon la revendication 16, dans lequel ladite bague interne (58) dudit ensemble de roulement à billes (57) est montée avec ajustage serré sur ladite surface de montage externe (36) de ladite partie de diamètre réduit (34) pour retenir ladite rondelle de butée (39) contre ladite surface de butée (38), grâce à quoi ladite compression axiale dudit ressort de torsion (90) est maintenue.

18. Ensemble de découpleur selon la revendication 17, dans lequel ledit élément porteur présente une fente afin de permettre que ledit élément porteur fléchisse et s'adapte aux charges associées à la rotation dudit ensemble de découpleur.

FIG - 1

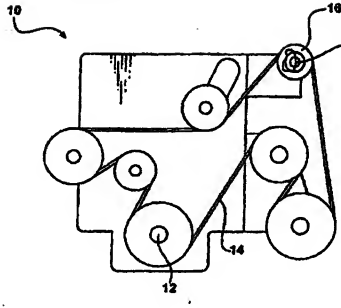

10
16
20
14
12

FIG - 2

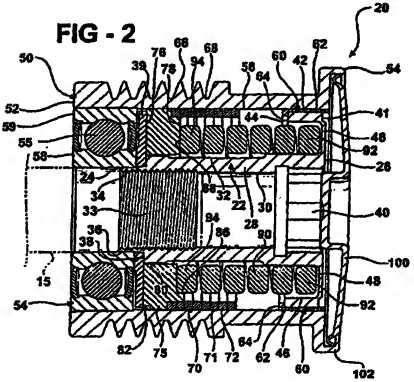

20
50
76
66
68
60
42
62
54
39
78
94
58
64
52
59
55
56
24
34
33
36
35
15
54
82
75
70
71
72
64
62
46
60
102
41
48
92
26
40
100
48
92

FIG - 3

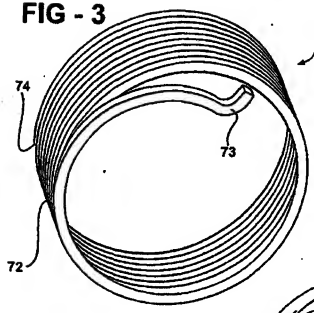



FIG - 4

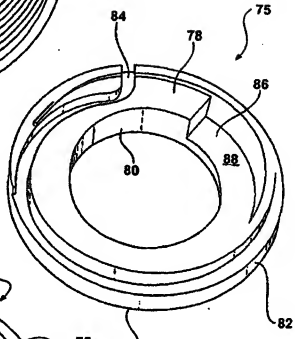
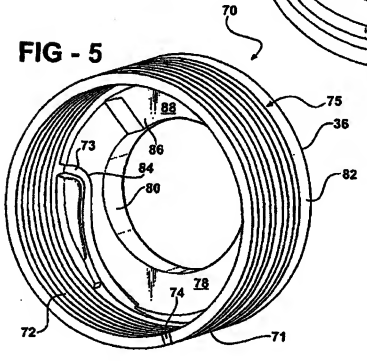



FIG - 5



## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- [redacted] [0004] [0005] [0009]
- [redacted] [0004]
- [redacted] [0006]


[redacted] CITED IN 1449/892